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This study reports the visual results of cataract surgery by a military resident and compares them to civilian surgeons. We reviewed the first 47 extracapsular cataract extractions performed by one resident military surgeon. Ninety-eight percent of eyes achieved a final visual acuity of 20/40 or better, and 95% were 20/25 or better. The mean surgically induced astigmatism was 0.54D, with 97%  $\pm$  2D from preoperative values. Eighty-three percent of eyes receiving intraocular lenses were within 2D of emmetropia. The mean residual refractive error in those eyes was +0.121. Complications were infrequent (17%). These results compare favorably with other published reports. (SLO)

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# Visual Results After Cataract Surgery by a Military Resident Surgeon

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## ABSTRACT

We compare the visual results of cataract surgery performed by a military resident with those achieved by civilian surgeons. Upon reviewing the first 47 extracapsular cataract extractions performed by one resident military surgeon, we found that 98% of eyes achieved a final visual acuity of 20/40 or better, and 95% were 20/25 or better. The mean surgically induced astigmatism was 0.54 diopters, with 97%  $\leq 2$  D from preoperative values. Eighty-three percent of eyes receiving intraocular lenses were within 2 D of emmetropia. The mean residual refractive error in those eyes was +0.121. Complications were infrequent (17%). These results compare favorably with other reports.

Several studies have reported visual results following cataract surgery by resident surgeons in civilian ophthalmology programs.<sup>1-7</sup> No studies, however, compare visual outcomes in civilian and military institutions. Only two of those studies have documented the visual outcomes of extracapsular cataract extraction (ECCE) by residents and compared the results with those obtained by experienced anterior segment surgeons.<sup>6,7</sup> We felt that further research would reinforce our conviction that ophthalmic residents perform ECCE successfully.

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## MATERIALS AND METHODS

**Patient Selection and Preoperative Evaluation.** We reviewed the first 47 ECCEs, with or without intraocular lens (IOL) implantation, performed by the first author during his residency at a military ophthalmology program. Prior to performing the first ECCE, the resident surgeon attended a three-day cataract surgery course, assisted in nine intracapsular and 32 extracapsular operations, and performed three intracapsular cataract extractions.

Patients were recruited from a general ophthalmology clinic using Jaffe's criteria<sup>8,9</sup>: vision was impaired by a cataract; the patient had two seeing eyes; the impairment of vision interfered with daily activities; there were no medical or ocular contraindications to surgery.

A preoperative examination with dilated pupils was performed, along with a physical examination, keratometry and A-scans in both eyes, and calculation of the IOL power using the Binkhorst formula aiming for a residual correction of -0.50 to -1.00 diopters.

**Surgical Technique.** All operations were planned ECCEs, with the exception of five phacoemulsifications on younger patients not receiving IOLs due to their age. Forty-five of the 47 operations were performed under local anesthesia, using a 50% mixture of 2% lidocaine and 0.75% bupivacaine with 150 units of Wydase for the Nadbath and retrobulbar injections. The surgical technique, similar in all operations, consisted of: a beveled incision at the blue line; expression of the lens nucleus; use of air to insert the IOL; one peripheral iridectomy; and subconjunctival injections of 0.5 cc of betamethasone and gentamicin. Healon<sup>®</sup> was not used. No primary posterior capsule discissions were done.

**Postoperative Care.** Patients were evaluated on the morning after surgery, when the patch was removed. Eye protection, either a shield or glasses, was con-

tinued for 6 to 8 weeks. A postoperative steroid (prednisolone acetate 1%) was used, but antibiotics were not. Postoperative evaluations were done at two to three days, 1 week, 3 weeks, and 6 to 8 weeks. Sutures were cut beginning at 6 to 8 weeks, until the desired astigmatic error was reached and verified by keratometry and refraction.

## RESULTS

**Patients.** Forty-seven eyes of 44 patients underwent ECCE with or without IOL implantation. Twenty-eight (60%) of the eyes were right eyes, and 19 (40%) were left eyes. Twenty-five (57%) patients were men, and 19 (43%) were women. Ages ranged from 28 to 93 years, with a mean of 59. Thirty-two patients (73%) were from 50 to 70 years of age. Preoperative visual acuity ranged from 20/50 to worse than 20/800 (Figure 1).

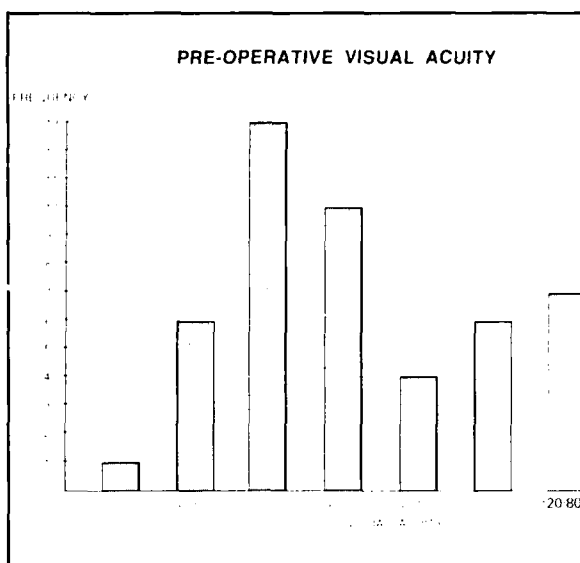
Thirty-three eyes (70%) received an IOL at the time of surgery: 31 (94%) were posterior chamber and two (6%) were anterior chamber lenses. Twelve eyes were intentionally left aphakic, either because the patients were young or because the opposite eye was aphakic. Two eyes did not receive an IOL because of vitreous loss.

The average follow-up was 18 months, with a range of 2 weeks to 54 months. Thirty-seven eyes (79%) had a follow-up of at least 3 months. Six eyes (13%) were lost to follow-up: two had uneventful ECCEs; two had uneventful ECCEs with insertion of posterior chamber IOLs; and two suffered vitreous loss and did not receive IOLs.

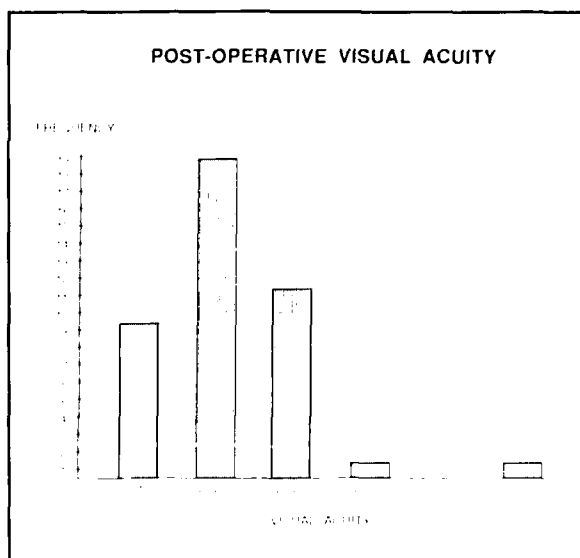
**Visual Acuity Results.** Of the 41 eyes (87%) with a final refracted visual acuity, 40 (98%) achieved a final visual acuity of 20/40 or better (Figure 2). Thirty-nine eyes (95%) achieved a final visual acuity of 20/25 or better. Twenty-eight eyes (68%) achieved a final visual acuity of 20/20 or better. Only two eyes failed to achieve a visual acuity of 20/25. The first was that of an elderly man (82 years) whose zonules ruptured on expression of the nucleus and who underwent mechanized vitrectomy with insertion of an anterior chamber IOL. At 6 months, he still had cystoid macular edema and a best corrected visual acuity of 20/80, the same as before surgery. The other eye was that of a woman (39 years) who had a phacoemulsification and 20/20 acuity shortly after surgery. However, when her best visual acuity was reported with a soft contact lens at 51 months, it had decreased to 20/30. No mention was made of her posterior capsule or macula.

Thirty-one of the 33 eyes (94%) receiving IOLs had a final refracted visual acuity. Thirty eyes (97%) were 20/40 or better; 29 (94%) were 20/25 or better; and 23 (74%) were 20/20 or better.

**Refractive Results.** Final postoperative refractions were available for 30 (91%) of the 33 eyes receiving IOLs. Twenty eyes (67%) were within 1 D (spherical equivalent) of emmetropia, and 25 (83%) were within 2 D (Figure 3). Five eyes (17%) were between 2.25 and 2.75 D



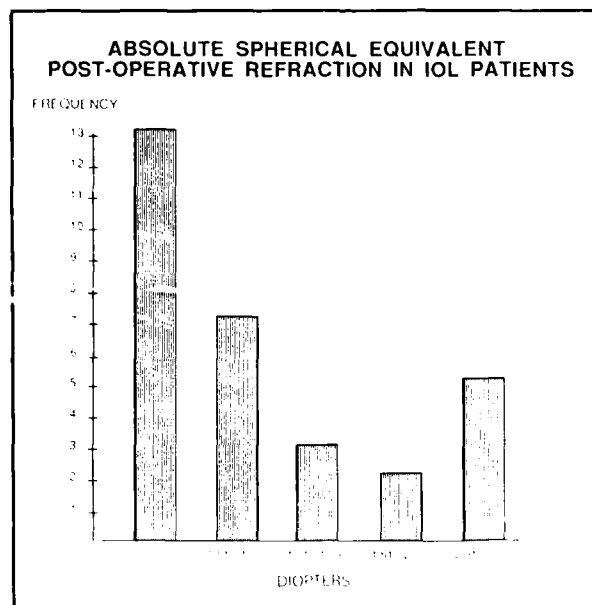
**FIGURE 1:** Preoperative visual acuities in patients undergoing ECCE.



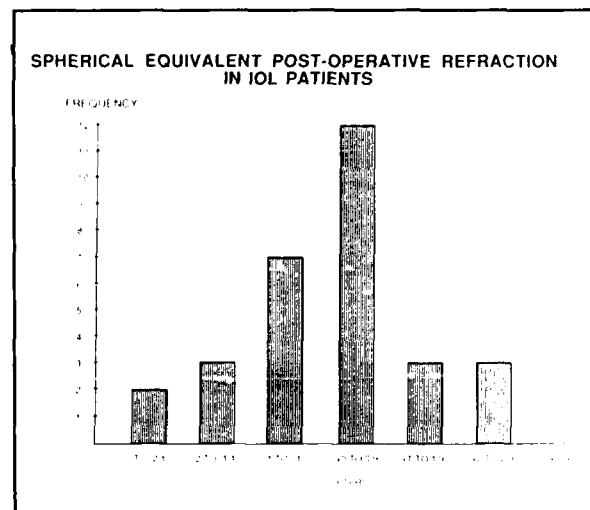
**FIGURE 2:** Postoperative visual acuities in patients after ECCE with and without an IOL.

of emmetropia. The mean residual refractive error was +0.121, with a range of -2.37 to +2.75 D. The most common postoperative refraction range was 0.0 to +0.9 D: 12 eyes (40%) (Figure 4). In all, 16 eyes (53%) were hyperopic. Large hyperopic (>+1.00 D) and myopic (>-2.00 D) residual refractions were uncommon: five were hyperopic (17%) and two were myopic (6.7%).

Of these 30 eyes, information on intended postoperative spherical refractive error was available on 17 (57%) for comparison with the final postoperative refraction. Eight eyes (47%) were within 1 D of the calculated



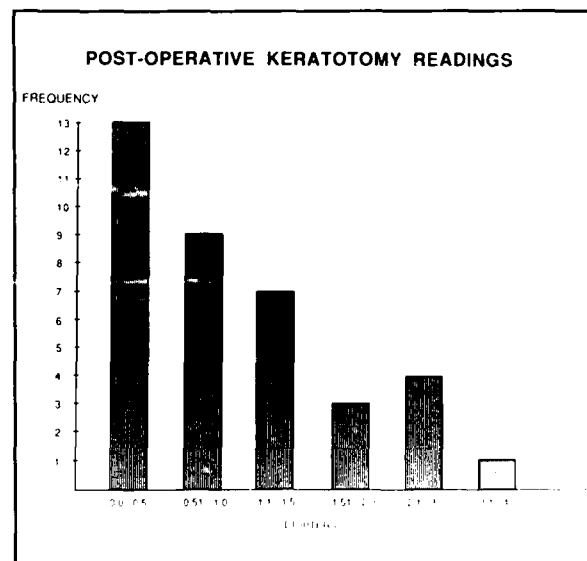
**FIGURE 3:** Absolute spherical equivalent postoperative refraction in IOL patients.



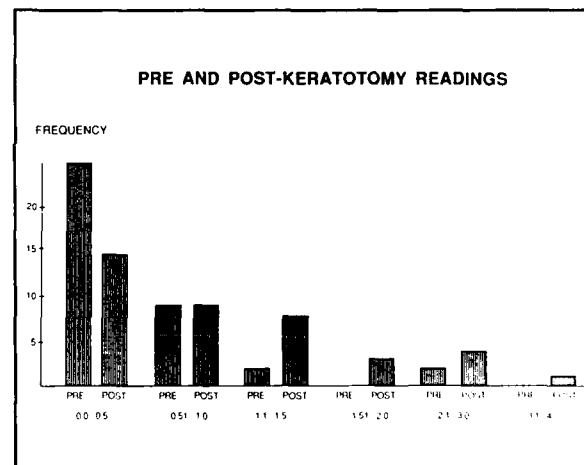
**FIGURE 4:** Spherical equivalent postoperative refraction in IOL patients.

intended postoperative refraction, and 15 eyes (88%) were within 2 D. Two eyes (12%) were more than 2 D from the intended postoperative refraction (2.08 and 3.75 D). Neither was an optical problem for the patient.

**Keratometric Results.** Postoperative keratometry values were available on 37 eyes (79%) (Figure 5). The mean difference was 1.10 D, with a range of 0.00 to 3.50 D. Twenty-two eyes (60%) had less than or equal to a 1 D difference, 32 eyes (86%) had less than or equal to a 2 D difference, and five eyes (14%) had more than a 2 D difference.



**FIGURE 5:** Postoperative keratotomy readings.



**FIGURE 6:** Comparison of preoperative and postoperative keratotomy readings.

Preoperative and postoperative keratometric values were available for 36 of the 37 eyes (Figure 6). Preoperatively, the mean difference in the readings was 0.57 D, with a range of 0.00 to 2.50 D. Postoperatively, the mean difference in the readings was 1.11 D, with a range of 0.00 to 3.50 D. Thus, the mean surgically induced astigmatism was only 0.54 D.

Twenty-four of these eyes (67%) had a difference of less than or equal to 1 D, and 35 eyes (97%) had a difference of less than or equal to 2 D from their preoperative values. In all, six eyes (17%) had a decrease in the difference of the keratometric readings, eight (22%) did not change, and 22 (61%) increased.

In one eye, all sutures were cut at 10 weeks, as recommended. This resulted in 3 D of against-the-rule cor-

**TABLE 1**  
**Complications**

|                             | Number  | Percent |
|-----------------------------|---------|---------|
| Vitreous loss               | 3 of 47 | 6.4%    |
| Wound leak                  | 1 of 47 | 2.1%    |
| Clinical CME at 2 months    | 3 of 40 | 7.5%    |
| Persistent uveitis >1 month | 2 of 41 | 4.9%    |

**TABLE 2**  
**Resident ECCE**

|                     | Number of Eyes | % 20/40 or Better | Average Follow-up (months) | Method of Cataract Extraction |
|---------------------|----------------|-------------------|----------------------------|-------------------------------|
| Reinhart & Annable  | 22             | 68%               |                            | I                             |
| Holt et al          | 84             | 68%               | 8.4                        | I                             |
| Kersten & Kolder    | 88             | 82%               | 19                         | I                             |
| Wong & Kline        | 291            | 88%               | 12                         | I/E 60%                       |
| Neuhaus & Straatsma | 28             | 81.2%             | 12                         | I                             |
| Straatsma et al     | 144            | 88%               | 5                          | E                             |
| Browning & Cobo     | 130            | 89%               | 5                          | E                             |
| Green & Peters      | 41             | 98%               | 19                         | E                             |

neal astigmatism at 5 months. The patient had 1 D of astigmatism before surgery. One patient broke all of his sutures soon after surgery, resulting in 1.50 D of astigmatism at 3½ months. The patient had no astigmatism before surgery.

One patient, who had a wound leak repaired, had 1.25 D of astigmatism postoperatively, an increase of 0.75 D from preoperative readings.

Three of five patients who underwent phacoemulsification with 8-0 Dexon closure had essentially no increase in astigmatism (0.25, 0.00, and 0.00 D). Postoperative keratometry readings were not available for the other two.

**Complications** (Table 1). Three eyes developed intraoperative vitreous loss, and posterior chamber IOL implantation was aborted. One of these eyes received an anterior chamber lens and stabilized at 20/80 because of cystoid macular edema (CME). This was the only case in which visual acuity was affected by a complication. The other two eyes were lost to follow-up. These were operations 1, 10, and 28.

**TABLE 3**  
**Experienced Surgeon ECCE**

|                   | Number of Eyes | % 20/40 or Better | Average Follow-up |
|-------------------|----------------|-------------------|-------------------|
| Kratz et al       | 250            | 89%               | 7 mos             |
| Kratz             | 1000           | 91.2%             | 6-24 mos          |
| Stark et al       | 614            | 89%               | >1 yr             |
| Jaffe             | 800            | 92%               | 1 yr              |
| Kraff             | 1216           | 90%               | No mention        |
| Shearing          | 100            | 90%               | 5 yrs             |
| Southwick & Olson | 168            | 89.3%             | 5 yrs             |
| McCaffery & Lusby | 512            | 95.9%             | 2 yrs             |

Three eyes had clinical cystoid macular edema at 2 months (one is mentioned above). Two others developed CME after uneventful ECCE and posterior chamber IOL implantation, but their final acuities were 20/20 at 3 and 5 months.

One eye developed a wound leak (cause unknown) 1 month after an uncomplicated planned ECCE. Because of vitreous at the wound, that eye underwent an anterior vitrectomy and achieved a final acuity of 20/15.

Two eyes had mild persistent uveitis 4 weeks postoperatively. In one patient, this resolved with topical steroids and was not apparent at the 3-month final examination when the acuity was 20/20. The other patient was lost to follow-up after 1 month.

## DISCUSSION

We have shown that 98% of patients operated on by a military ophthalmology resident achieved a visual acuity of 20/40 or better at 19 months. This is comparable to the results of civilian resident cataract surgeons listed in Table 2 (68% to 88%) and experienced ECCE surgeons listed in Table 3 (89% to 96%). Our findings demonstrate that military standards and outcomes, at least in one resident surgeon's experience, are on a par with those of the local community.

Complications occurred relatively infrequently (17%). The number and type are comparable to the complications listed by civilian residents and experienced anterior segment surgeons in Table 4.

Our data further support the conclusion that residents can successfully learn and perform ECCE with posterior chamber IOL implantation as their first cataract surgical technique with a safety and efficacy comparable to community professional standards.

An unexpected finding was that 53% of eyes were hyperopic postoperatively. In the majority of these eyes (69%) this was minimal:  $\leq +1.00$  D. The hyperopia was not noted by any patient.

Surgically induced corneal astigmatism was not a

**TABLE 4**  
**Complications of ECCE**

| Resident        | Vitreous Loss | CME  | Uveitis | Wound Leak    |
|-----------------|---------------|------|---------|---------------|
| Wong & Kline    | 2.7%          | 4.1% | 1.5%    | 1.5%          |
| Straatsma et al | 2.9%          | 5.0% | 0.7%    | 1.4%          |
| Browning & Cobo | 9%            | 3.1% |         | 2.3%          |
| Green & Peters  | 6.4%          | 7.5% | 4.9%    | 2.1%          |
| <b>Staff</b>    |               |      |         |               |
| References      |               |      |         |               |
| 10-17 (ranges)  | 0.3-2.9%      | 1-6% | 0.7-4%  | None reported |

major problem. On average, we found that the cataract surgery brought about an increase in the keratotomy readings of only 0.5 D. Comparing our astigmatism results with the only other resident data on this subject revealed that preoperatively 5.6% and postoperatively 14% of eyes had >2 D of corneal astigmatism, whereas Browning and Cobo<sup>7</sup> reported 3% and 22%, respectively.

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